**Introduction**

For years, extinction has been a major problem in the past due to natural and human causes. But, now, we have the technology to bring back these extinct species in a process called de-extinction. Using synthetic biology we can bring back a species from extinction as long as we have the extinct species’ DNA intact.

**Extinction**

In order to understand de-extinction, the concept of extinction must be understood. It is important to understand extinction, the reasons for it and its effects, because it will help to understand the reasons why people want to bring extinct species.

*“Natural” Extinction*

Extinction has occurred for centuries. Animals such as the woolly mammoth, dodo bird, and the saber-tooth tiger went extinct back in 1600 BC. Some species like these died from natural causes including: changes in climate, changes in sea level, cosmic radiation, acid rain, and disease.

*Human Causing Extinction*

However, natural causes are not the only reason for extinction. Humans cause many species to go extinct as well through hunting, destruction of habitat, global warming, pollution, and introducing invasive species. While recently we have been trying to save species that are endangered, we have also been the cause of endangerment and extinction.

*Problems with Extinction*

Several species have gone extinct, including: passenger pigeons, saber-tooth tigers, Tasmanian tigers, dodo birds, Baiji White Dolphins, and recently, the West African black rhinoceros. These are only a few species that have gone extinct. Extinction is a major problem, not just because we lose an entire species, but because it also alters the food chain. This can cause a domino effect where even more species to become extinct.

**De-Extinction**

As science develops, we have found new and more exciting theories. One of these many theories is de-extinction. Using methods such as CRISPR, we can bring a species back to life. Using already existing species, we can change some of its genes to match the extinct species genes. This will eventually get back the extinct species.

*The Basic Science*

For example, let’s use a passenger pigeon. Probably using the band-tailed pigeon, because it is the closest genetically, we would recreate the passenger pigeon that went extinct in 1914. However, since most people are more familiar with a chicken, we will just use a chicken as our example.

The first step is to compare the difference in DNA within a stem cell. Since they are both birds, they will have many similarities, but there will be a few differences. In these differences, we will insert the passenger pigeon’s DNA into the Chicken’s.

The stem cells will be put into chicken egg in replacement of the chicken germ cells. The chicken will grow up with passenger pigeon gametes. That way, when two of these chickens mate, their baby will be a passenger pigeon. Repeating this process and having the passenger pigeons mate, we can bring back that species.

**Examples**

Using this method, we can bring some animals back from extinction. However, we cannot bring them all back. For this process to work, the extinct species must have DNA that is intact. Some species that might be brought back include the passenger pigeon, shown in the example earlier, and the woolly mammoth. The passenger pigeon DNA was preserved and is more recent extinct. The woolly mammoth also has DNA that is intact. We have found a really well preserved woolly mammoth in ice that had DNA remanence in it.

*The Passenger Pigeon*

The closest living relative of the passenger pigeon is the band-tailed pigeon. Using the band-tailed pigeon we can compare the DNA and do the de-extinction process. Since this species is the closest relative, there will be less changes that have to be made using CRISPR.

Doing this we can fix our wrong doing. Originally, there were three to five million passenger pigeons in the United States. However, by 1914 we hunted them to extinction. They were thought of as an easy way to make money and get food. If we can bring the back to life, we can fix what we have done to them.

*The Woolly Mammoth*

The woolly mammoth’s closest living relative is the Asian Elephant. Using the same process as the passenger pigeon, we can bring woolly mammoths back from extinction. We can bring back one of the most iconic extinct figures.

Some people are strongly against bringing back the ancient woolly mammoth, while others think it would be extremely beneficial.

**Concerns**

Mentioned earlier, there are several concerns with de-extinction. These concerns mainly fall under ethics/morals and environment.

*Ethics/Morals*

As far as ethics/morals goes, they are rhetorical questions. One religious based question that is being asked is: Are we playing God? This is one of the major questions asked. We are toying with life at this point. For those that are religious, the typical idea is that God created everything. So, if we were to create life, bring back an extinct species, we would be playing God. Since we are human and not God, that is seen as a bad thing.

Another rhetorical question is: At what point do we stop meddling with life? Or, is there a line where we shouldn’t cross when it comes to resurrection? Where is it? These are all good questions, that no one really knows the answer too. Some people believe if we keep going on this biological track, we will end up on a slippery slope that we can’t get back from. It’s the fear of creating something we cannot stop if something happens to go wrong. People are worried about what the unknown has, and they have the right to be. But in some cases, we should explore.

*Environment*

There are also quite a few concerns about the environment. One of these concerns is that the resurrected species will have no place to go. Their original environment may no longer exist.

Another concern is that the de-extinct species will kill of the endangered species. They could potentially become a threat to animals we are trying to save today. Others think that larger animals will destroy the environment itself. For example, these people think that woolly mammoths will destroy the already melting ice.

**Why?**

Why would we want to continue with de-extinction with so many reasonable concerns? Well, in fact, bringing back some extinct species would be very beneficial. Reasons why we should continue with de-extinction process include ethics/morals, environment, and a few others that do not fall under those categories.

*Ethics/Morals*

One of the main ideas for de-extinction, on the moral side, is that we have a “moral obligation” to bring species back to life. In the past have done a lot of harm to the environment, and it is about time that we should fix it as much and as best as we can.

*Environment*

Contrary to some of the environmental concerns listed earlier, these extinct species can actually be very beneficial to nature.

For example, woolly mammoths can actually save the ice from melting. They can pack down the ice to keep it from moving and help it to freeze. It can also help the grasslands grow to insulate the tundra. Also, they can help to spread nutrients through their dung.

Bringing back these extinct creatures will restore the ecosystem.

*Other Reasons*

Besides ethics/morals and the environment, there are a few other reasons why we would try and bring back the species. First of all we want to see if we can actually do it. Although this is not as solid reason as the others may be, scientists are always curious to see if they can find something new or to see how something works. Finding out if it actually works is a scientist’s dream.

Another reason we would do this is to learn more about animal conservation. If this works, we can also save other extinct animals, endangered animals, and animals who might not make it on their own in the future.

Lastly, doing this experiment will help us to understand animal blood. Knowing this better, we can make better antibiotics and more antibiotics to fight off diseases. This would really help in the medicine field.

**Overview**

We have already started the process of de-extinction. One of the first times was in 2003 when Russian scientists brought back a type of deer that was originally extinct. Scientists plan to bring back animals such as the woolly mammoth and the passenger pigeon. Here is a summary of what you just read:

*The Science*

Taking the closest living relative, compare the DNA and replace those parts in the closest living relative DNA with the extinct species. Insert this stem cell into an egg (if a bird) and let it grow up. Mate two of these animals with extinct animal gametes. They should produce the extinct baby animal.

*Examples*

The passenger pigeon is one of the extinct animals that scientists are thinking of making de-extinct. To do this, they would likely use CRISPR and the band-tailed pigeon since it is the closest living relative.

Another extinct animal that scientists are thinking of bringing back is the woolly mammoth. While some people are very against doing it, there are many benefits to bringing the woolly mammoth back. For this process, scientists would use the Asian elephant.

*Concerns*

There are quite a few concerns such as not having the right environment. The world has changed a lot and much of the landscape that was once there, is no longer there. Others worry that we are playing God’s role and that we should not meddle so much with life. And, lastly, some people think that the de-extinct animals might cause endangered animals to become extinct.

*Why?*

There are also several reasons why we should bring back these species. First of all, it could save us from the melting ice. One of the most important arguments is that it is our “moral obligation” to do everything in our power to fix nature since we destroyed it so much. Also, some scientists just want to do it to see if it actually can be done. And if we can actually do it, we can better understand biology and could make more effective medicine as well as being able to save more species in the future.